REMARKS

Independent Claims 1, 17, and 30 have been amended to make it clear that the heating of the dielectric member through which power is transmitted is uniform heating, whereby uniform transfer of power is achieved, due to a uniform reduction in the deposition of power-transfer-blocking materials upon the dielectric member. In addition, the heating of the dielectric member is carried out only while processing power is passing through the dielectric member, i.e., during the plasma treatment of the substrate. Support for this amendment of the claims is provided in the application as originally filed at Page 32, lines 12 - 25, where applicants teach that the dielectric ceiling 110 of the process chamber is heated to a temperature above about 150 °C by multiple heating elements interior to the dielectric material, or that the dielectric ceiling may be heated by irradiation from a lamp, or by hot air from a hot-air blower. The heating of the dielectric member is carried out while processing power is passing through the dielectric member as discussed at Page 33, line 32, continuing at Page 34, lines 1 - 2. All of the means of heating are designed to produce a uniform temperature above about 150 °C over the portion of the dielectric ceiling through which processing power passes. Additional support is provided at Page 46, lines 26 - 27, where applicants explain that during their experimentation they used irradiation by a lamp to heat the dome of a DPS brand chamber. One skilled in the art will recognize that the irradiation from a lamp provides uniform heating over the surface irradiated without impacting the surface of the dielectric and without creating a high delta in temperature at an isolated point, which places stress on the dielectric material.

Additional support is provided at Pages 47 and 48, where applicants teach that when the interior surface of the dielectric member exhibits a temperature greater than about 150 °C, during the etching of a platinum layer, although there is a formation of a very thin deposition layer of etch byproducts on the dielectric member (dome), there is a significant improvement in the maintenance of electrical conductivity through the dome compared with decrease in electrical conductivity through the dome when the dome temperature is about 80 °C. Applicants stated that at temperatures higher than 150 °C, there would be essentially no conductive film deposit on the interior surface of the dome during etch processing of the platinum layer. (Page 48, TABLE, lines 7 - 11, and lines 12 - 24.)

Rejections Under 35 USC § 102:

Claims 1, 3 - 5, and 10 - 15 are rejected under 35 U.S.C. §102(b) as being anticipated by US Patent 5,531,834 issued to Ishizuka et al.

Applicants respectfully contend that the Ishizuka et al. reference does not anticipate applicants' invention. The Ishizuka et al. disclosure focuses on the production of a high density plasma at a low pressure. There is a mention that it is advantageous to remove contaminants from process chamber walls in general so that a cleaning of the walls is not required as often (for removal of particulates which may contaminate the substrates processed in the chamber). It is taught that heating of process chamber walls helps reduce the accumulation of deposits which produce contaminants. However, there is no mention of any need to uniformly remove contaminants from one surface in the process chamber, but not from others. Applicants' disclosure focuses on methods of controlling power transfer into the process chamber. The power transfer is through a dielectric window or dome. To get a stable transfer of power through the dielectric window or dome, it is necessary to control the deposition of conductive materials on the dome, while it is not as critical whether conductive materials accumulate elsewhere in the processing chamber. In one of applicants' embodiments, it is desired to uniformly control the amount of conductive materials which accumulate on the dielectric window, to provide a uniform and stable power transfer through the window. It is necessary to ensure that conductive materials do not deposit on the dielectric window or dome unevenly. Of course the preferred state is when there is no deposition at all on the dielectric window, but in fact, there is typically some deposition. In one of applicants' methods of controlling the deposition of conductive materials on the dielectric window, applicants used uniform heating to heat the surface of the dielectric window, to reduce the amount of conductive material depositing on the window. When the temperature of the dielectric window surface was at least about 150 °C, there was minimal conductive material deposition. When the temperature of the dielectric window surface was at least 225°C, the result was even better. The dielectric window is heated uniformly by incorporating heating elements into the dielectric window material, or by using irradiation from a bulb, or by using a hot air blower, for example.

There is no mention in the Ishizuka et al. disclosure of the need to uniformly heat a dielectric window in the process chamber so that power transmission through the window will be uniform. In fact, the two processing chamber Figures, Figures 1 and 7 show that while the stainless steel walls of the

process chamber are directly heated, the quartz window at the top of the chamber is not directly heated (evidently for fear of cracking the quartz plate). As a result, heat is conducted from the edges of the quartz plate adjacent the stainless steel chamber walls, and heating of the quartz plate is not even. This is likely to lead to more accumulation of depositing materials in the center of the plate than at the edges of the plate which are at a higher temperature. However, as previously mentioned, the Ishizuka et al disclosure does not address power transmission uniformity through the quartz plate. The Ishizuka et al. disclosure does not anticipate applicants' invention.

In more detail, the Ishizuka et al. reference is focused on a plasma film forming apparatus which makes use of an electrode in the form of a flat coil facing another electrode. "When radio-frequency power is applied between the pair of electrodes, a radio-frequency electric field is formed. Since one of the electrodes is the flat coil, however, a magnetic field is formed. As a result, the processing gas is converted into a plasma by electrical and magnetic energies. Accordingly, the processing gas can be changed into a plasma under low pressure, and a high-density plasma can be generated even under a pressure of 0.1 Torr or below. Thus, the efficiency of ion application to the surface of the object of processing is high and the effect of impurity extraction is high." (Abstract) The goal is to be able to obtain "a high-density plasma even when the pressure of processing gases is low, so that a high-quality film with a satisfactory filling property can be formed." (Col. 2, lines 52 - 57) In several embodiments of the apparatus, as illustrated in Figures 1 and 7, the airtight processing chamber walls 1 are formed of, e.g., stainless steel. There is a quartz plate 12 at the top of the processing chamber. There are heating elements 40 which are used to heat the stainless steel chamber walls, but these heating elements are absent in the area of the quartz plate 12, so that quartz plate 12 is heated by conduction only from the edges which are adjacent the stainless steel chamber walls. This results in an uneven heating of the surface area of the quartz plate. This may be because there was concern about cracking of quartz plate 12 if the heating elements 40 were adjacent quartz plate 12. For example, there is a mention that it is preferable that the electrode coil 13 not be placed in contact with plate 12, since this will reduce sputtering of the quartz plate surface so there is less of a possibility that heat generated from the sputtering will crack the quartz plate. (Col. 7, lines 10 - 14).

In any case, while the teachings of the Ishizuka et al. reference include an acknowledgment that it is advantageous to remove contaminants from the process chamber in general, so that the chamber can be

cleaned less often, there is no mention that contaminants must be uniformly removed from any one surface within the chamber.

Applicants are concerned with controlling the transfer of power through a dielectric window into the process chamber. Applicants describe several techniques for controlling the power transfer. In amended Claims 1, 3 - 5, and 10 - 15, applicants claim a method of processing a metal layer on a substrate in a process chamber which includes a load-bearing dielectric member through which power from an inductive power source is transferred. To ensure a more uniform transfer of power through the dielectric member, at least a portion of the dielectric member through which the processing power passes is uniformly heated to a temperature which decreases the deposition of power-transfer-blocking materials, such as metals. Applicants contend that the subject matter of these claims is not anticipated or even suggested in the Ishizuka et al. reference.

In light of the above distinctions, the Examiner is respectfully requested to withdraw the rejection of Claims 1, 3 - 5, and 10 - 15 under 35 U.S.C. §102(b) as being anticipated by Ishizuka et al.

Claims 1, 3 - 5, 8, 10 - 15, 17 and 19 - 28 are rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent 5,690,050 issued to Doi.

Applicants are prepared to "swear behind" the date of the Doi reference with respect to the rejection under 35 U.S.C. § 102(a) if necessary. However, applicants' attorney does not believe this is necessary, and contends that Claims 1, 3 - 5, 8, 10 - 15, 17, and 19 - 28 are not anticipated by U.S. Patent No. 5,690,050 to Doi.

The Doi reference pertains to the use of hot air heating for heating a dielectric container of a helicon wave excited plasma generator. (Abstract; Figure 1& Col. 1, lines 30 - 52; Col. 2, lines 51 - 65; and Col. 4, lines 2 - 8). The focus appears to be on the prevention of the formation of a film on an interior surface of the dielectric container, which film peels away from the inside surface of the dielectric container and falls upon the substrate, as illustrated in Figure 4. (Col. 2, lines 16 - 21.) There is also a discussion of conductive organic thin film deposits on the inside surface of the dielectric container where "the high frequency electric power may be extraordinarily guided into the dielectric container". (Col. 2, lines 21 - 24.) There is also a discussion that plasma emission photospectrometry through the dielectric container may not be effective when deposited film shades light emitted by the plasma. (Col. 2,

lines 25 - 29). However, there is no discussion that when metal layers, in particular, are processed in the plasma chamber used by Doi there is a deposition of a conductive film from metal-containing process byproducts which creates a non-uniform reduction in power transmission into the plasma. This may be because the plasma processing chamber used in the Doi reference experimentation was a different kind of plasma processing chamber than that used by applicants. The observations of processing variable effects is not directly translatable. The description provided in Doi provides some generalized comments at the end that the Doi method can be applied to any known plasma processing chamber, but this is not enabling for different processes which must be developed for use in other distinctly different kinds of plasma processing chambers. Further, the principal problem to be solved by applicants is not the problem which was the focus of the Doi invention. Applicants invention as claimed herein is not anticipated by the Doi reference.

In more detail, there is a particular focus in the Doi disclosure on the use of a hot air blower to heat the helicon source reactor dielectric container <u>between a first plasma treatment and a second plasma treatment to prevent film formation and that the hot air blower treatment is halted "only when the apparatus itself is completely halted for maintenance".</u> (Col.7, lines 61 - 67, continuing at Col. 8, lines 1 - 2.) This contrasts with applicants' disclosure which is focused on methods of obtaining a uniform transfer of power through a dielectric member (which is typically a window or a dome) during the plasma processing of a metal layer for a single wafer. The dielectric member described with reference to applicants' experimentation is not a dielectric container of the kind shown in Figures 1 - 4 of the Doi reference (which is described as being a cylindrical member of which one end is open and the other end is formed into a semi-spherical shape). (Col. 4, lines 36 - 38.) This kind of processing apparatus is shown by applicants in prior art Figures 9 and 10 for a helicon source reactor. Applicants' processing apparatus was an inductively coupled RF plasma reactor of the kind shown in figures 12 and 13, for example. As a result, the kind of processing problems encountered by applicants were different from those encountered and described by Doi, and applicants' claims pertain to solving of a different problem.

While the teachings of the Doi reference might encourage one skilled in the art to try heating of a dielectric member as a means of reducing film formation, there is no certainty that such heating would reduce the uneven, non-uniform, and constantly changing power transmission encountered by applicants during their platinum etching process, for example. Obvious to try is not the standard for obviousness

under 35 U.S.C. § 103, and certainly does not meet the requirements for anticipation under 35 U.S.C. § 102(a).

With respect to the case law, as mentioned above, "Obvious to try" is not the standard for obviousness under 35 U.S.C. § 103. "The mere need for experimentation to determine parameters needed to make a device work is an application of the often rejected obvious-to-try standard and falls short of the statutory obviousness of 35 U.S.C. §103." (*Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).) "An 'obvious-to-try' situation exists when a general disclosure may pique the scientist's curiosity, such that further investigation might be done as a result of the disclosure, but the disclosure itself does not contain a sufficient teaching of how to obtain the desired result or indicate that the claimed result would be obtained if certain directions were pursued." (*In re Eli Lilly & Co.*, 902 F.2d 943, 14 U.S.P.Q. 2d 1741 (Fed.Cir. 1990).) In the present instance, there is no mention in the reference of the formation of power-transmission-blocking metallic deposits on the surface of a dielectric member, and the need to reduce and control such power-transmission-blocking deposits during the processing of metal layers, so that uniform power transfer through the dielectric member into a plasma processing chamber is achieved.

In view of the above distinctions, the Examiner is respectfully requested to withdraw the rejection of Claims 1, 3 - 5, 8, 10 - 15, 17 and 19 - 28 under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent 5,690,050 issued to Doi.

<u>Rejections Under 35 USC § 103</u>

Claims 1, 3 - 5, 8 - 17, and 19 - 38 are rejected under 35 U.S. C. § 103(a) as being unpatentable over U.S. Patent 5,515,984 issued to Yokoyama et al., in view of U.S. Patent 5,735,993 issued to Yoshida.

Applicants respectfully contend that Claims 1, 3 - 5, 8 - 17, and 19 - 38 are not obvious over the combination of the Yokoyama et al. and Yoshida references. The Yokoyama et al. reference pertains to the etching of a platinum film by using an etching mask, a particular etchant gas mixture and subsequently removing side-wall build up off the etched structure using a wet acid etch. The Examiner

acknowledges that the Yokoyama et al. reference does not mention the heating of the dielectric portion of the plasma chamber through which the plasma energy passes. The Yoshida reference pertains to a plasma processing apparatus which includes a resistor plate buried in a dielectric member of the apparatus to reduce capacitive coupling components in the plasma and to function as the electromagnetic wave transmitting and heating member. The basic concept in the Yoshida reference relates to a relationship between the number of wafers etched and the taper angle of an etched polysilicon structure. The use of heat to reduce the amount of etch byproducts which accumulate on the dielectric member is said to keep these etch byproducts on the surface being etched (rather than on the dielectric member) so that the conditions on the surface being etched remain constant. Applicants' invention pertains to a method of maintaining a more constant transfer of power through a dielectric window <u>from an electromagnetic wave transmitting apparatus which is exterior to the dielectric window so that the power travels through the window</u>. Applicants' apparatus is the prior art apparatus which the Yoshida reference teaches is inadequate. Applicants' invention pertains to maintaining a more constant and uniform transfer of power through a dielectric window during the <u>processing of a single wafer</u>. Applicants' invention is focused on controlling the power transfer conditions in the manner shown on the table at Page 48 so that imperfections in a single wafer can be reduced. There is nothing in the Yoshida reference which discusses changes in power transfer through the dielectric window during the etching of a metal layer which produces etch-byproducts which change the power transmission differently at different locations on the surface of the dielectric window, thereby affecting surface conditions on a single wafer surface.

There is nothing in the Yoshida reference which would suggest combining this reference with the Yokoyama et al. reference, but even if the references are combined, this does not lead to applicants' invention. One skilled in the art might decide to try a metal plate embedded in a dielectric window as both an electromagnetic wave transmitting and heat conducting member during the etching of a platinum layer on a semiconductor substrate, but there is no certainty that this would have a particular effect on the etched platinum structure on a wafer surface.

In more detail, in the Yoshida reference, sputtering of the dielectric member is said to be reduced during the plasma generation process, while deposition of plasma etched products on the dielectric

surface is said to be suppressed by controlled heating of the dielectric, thereby alleviating the problem of contaminating particle generation and increasing etching condition stability. (Abstract). The Examiner cites the mention of controlled heating of the dielectric and increased etching stability as representative of the concept of applicants' invention. However, the Yoshida et al. reference describes the problem to be solved as follows at Col. 2, lines 30 - 37 : ". . . as . . the number of processed wafers increases, the temperature of the dielectric increases causing reduction in the amount of etch product deposition on the dielectric. This in turn increases the amount of etch product deposition on the to be etched sample workpiece, thus changing the resulting etching dimension and shape. The basic concept is tied to a relationship between the number of wafers processed and changes in the taper angle of a polysilicon layer which is being etched. A combination of this concept with the teachings of the Yokoyama et al. reference which relates to process which combines particular dry plasma etchants with an acid wet etch after the dry etching process does not provide a method for allowing a stable power transmission into a plasma processing chamber.

In view of the above distinctions, the Examiner is respectfully requested to withdraw the rejection of Claims 1, 3 - 5, 8 - 17, and 19 - 38 under 35 U.S. C. § 103(a) as being unpatentable over Yokoyama et al., in view of Yoshida.

The amendments to the claims set forth above are fully supported by the specification, claim set, and drawings, as originally filed.

Applicants contend that the presently pending claims as amended are in condition for allowance, and the Examiner is respectfully requested to enter the present amendments and to pass the application to allowance.

The Examiner is invited to contact applicants' attorney with any questions or suggestions, at the telephone number provided below.

Respectfully Submitted,

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